بسم الله الرحمن الرحيم

Palestine Polytechnic University
College of

Mechanical Engineering Department
Theory of Machine
First Exam

www.vGloop.com/group.php?id=54

Instructor: En. Jalal Salaimeh
Date: 31/10/2011
Time: 75 min.

Student Name: صفحة طلاب وطالبات البوليتكنك
Student Number:
Section: 1

Notes: 1) Solve The following 3 problems on the same paper, each on page.
2) Write your name on each page.

Question #	1(5)	2(8)	3(7)	Total Grade (20)
Grade	2.5	5.5	7	15.0

P1) (5 points)

For each of the following mechanisms shown in Fig.1a,1b:
Find the number of degree of freedom for each mechanism.

$M = 3(n-1) - 2J_1 - J_2$

@ $n = 11$, $J_1 = 14$, $J_2 = 0$

$M = 3(11-1) - 2*14 - 0 = 2$

2.5/5

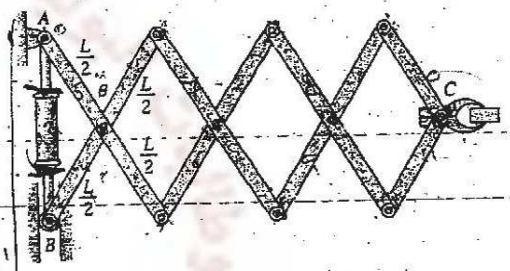

Fig.1a

$n = 6$, $J_1 = 6$, $J_2 = 0$

$M = 3(n-1) - 2J_1 - J_2$

$= 3(6-1) - 2*6 - 0$

$M = 3$

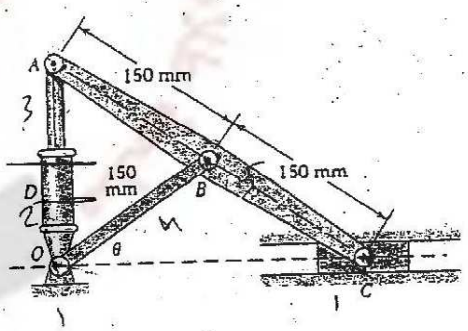

Fig.1b

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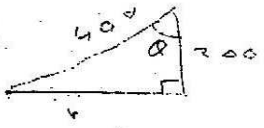
Student Number:

$\cos\theta = \frac{200}{400}$

$\theta = 60$



P2) (8 points)

For the quick return mechanism shown in Fig.2. link CA rotates with angular velocity ω =3 rad/s. :

a) Determine the type of motion of each link in the mechanism.
b) Determine the time ratio for the mechanism.
c) Find the angular velocity of link OB when θ=60.

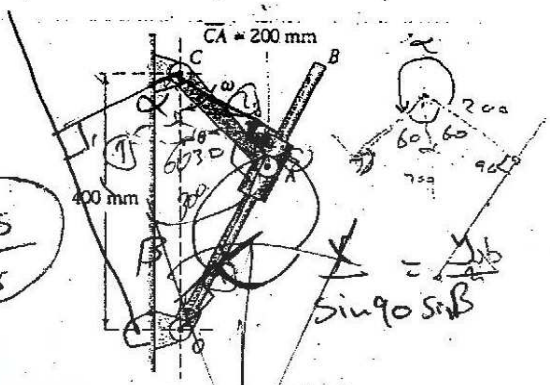


Fig.2

5.5/8

$\frac{Y}{\sin 90} = \frac{X}{\sin\beta}$

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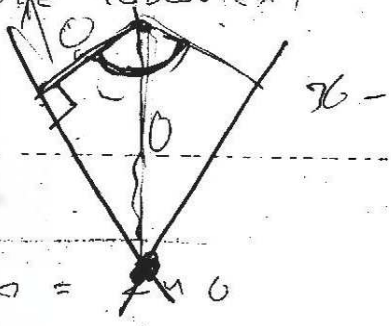
(a) Links

(1) fixed. (2) rotation (complete rotation)

(3) general plane motion.

(4) rotation (rocking)



(b) $\beta = 120$ where?

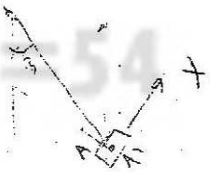
$\alpha = 360 - 120 = 240$

Time Ratio = Q = $\frac{\text{angle of advancing}}{\text{angle of returning}} = \frac{\alpha}{\beta}$

$Q = \frac{240}{120} = 2$

(c) Point A' is point near A on link OB

$V_A = V_{A'} + \omega \times r_{A/A'} + V_{rel}$



$\theta = \frac{\alpha t}{2\pi}$ $\frac{2\pi}{t}$ =

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P3) (7points)

Link BA in Fig. 3. rotates through a limited range of the angel β, and its end A causes the slotted link CA to rotate also. For the instant represented where β= 60, and angular velocity of BA ωBA= β constant = 0.6 rad/sec.
Determine:
a) Vrel. , arel. .
b) angular velocity and angular acceleration of link CA .

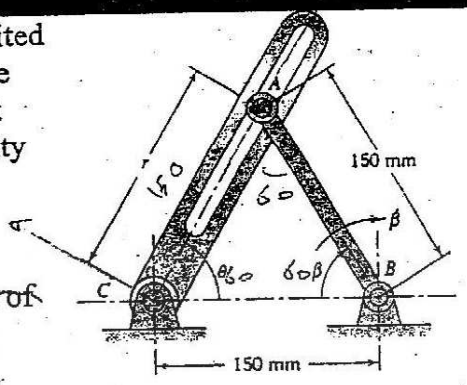

Fig.3

Point A' is point near A on Link CA

$V_A = V_{A'} + \omega \times r_{A/A'} + V_{rel}$

$r_{A/B} = +0.15\cos 60\, i + 0.15 \sin 60\, j$

$\dot{\beta} \times (r_{A/B}) = \omega_{CA} \times r_{A/C} + V_{rel}$

$(-0.6k) \times (+150\cos 60\, i + 150 \sin 60\, j) = (\omega_{CA} k) \times (150\, i) + V_{rel} i$

$-45\, j + 45\sqrt{3}\, i = 150\, \omega_{CA}\, j + V_{rel}\, i$

$V_{rel} = +45\sqrt{3} = +77.9$ mm/s

$\omega_{CA} = 0.3$ rad/s ↻

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(End of Exam)

continue